



SEP 02 2010

10CFR50.73

LR-N10-0320

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington DC 20555-001

LER 272/2010-002
Salem Nuclear Generating Station Unit 1
Facility Operating License No. DPR-70
NRC Docket No. 50-272

Subject: Automatic Reactor Trip Due to Main Power Transformer Bushing Failure

This Licensee Event Report, "Automatic Reactor Trip Due to Main Power Transformer Bushing Failure" is being submitted pursuant to the requirements of the Code of Federal Regulations 10CFR50.73(a)(2)(iv)(A).

The attached LER contains no commitments. Should you have any questions or comments regarding this submittal, please contact Mr. E. H. Villar at 856-339-5456.

Sincerely,

A handwritten signature in black ink, appearing to read "E. Eilola".

Edwin J. Eilola, Jr.
Salem Plant Manager

Attachments (1)

1 E22
NRR

SEP 02 2010

cc Mr. W. Dean, USNRC - Administrator - Region I
 Mr. R. Ennis, USNRC - Licensing Project Manager - Salem
 USNRC Senior Resident Inspector - Salem (X24)
 Mr. P. Mulligan, NJBNE Manager IV
 Mr. H. Berrick, Salem Commitment Tracking Coordinator
 Mr. L. Marabella, Corporate Commitment Tracking Coordinator

NRC FORM 366 (9-2007)		U.S. NUCLEAR REGULATORY COMMISSION		APPROVED BY OMB: NO. 3150-0104 EXPIRES: 08/31/2010		Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.					
<h2 style="margin: 0;">LICENSEE EVENT REPORT (LER)</h2>											
1. FACILITY NAME Salem Generating Station - Unit 1				2. DOCKET NUMBER 05000272		3. PAGE 1 of 4					
4. TITLE Automatic Reactor Trip Due to Main Power Transformer Bushing Failure											
5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED		
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER	
07	07	2010	2010	0 0 2	0	09	02	2010		DOCKET NUMBER	
9. OPERATING MODE <div style="text-align: center; font-size: 24pt;">1</div>			11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (Check all that apply)								
10. POWER LEVEL <div style="text-align: center; font-size: 24pt;">100%</div>			<div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"> <input type="checkbox"/> 20.2201(b) <input type="checkbox"/> 20.2201(d) <input type="checkbox"/> 20.2203(a)(1) <input type="checkbox"/> 20.2203(a)(2)(i) <input type="checkbox"/> 20.2203(a)(2)(ii) <input type="checkbox"/> 20.2203(a)(2)(iii) <input type="checkbox"/> 20.2203(a)(2)(iv) <input type="checkbox"/> 20.2203(a)(2)(v) <input type="checkbox"/> 20.2203(a)(2)(vi) </div> <div style="width: 50%;"> <input type="checkbox"/> 20.2203(a)(3)(i) <input type="checkbox"/> 20.2203(a)(3)(ii) <input type="checkbox"/> 20.2203(a)(4) <input type="checkbox"/> 50.36(c)(1)(i)(A) <input type="checkbox"/> 50.36(c)(1)(ii)(A) <input type="checkbox"/> 50.36(c)(2) <input type="checkbox"/> 50.46(a)(3)(ii) <input type="checkbox"/> 50.73(a)(2)(i)(A) <input type="checkbox"/> 50.73(a)(2)(i)(B) </div> <div style="width: 50%;"> <input type="checkbox"/> 50.73(a)(2)(i)(C) <input type="checkbox"/> 50.73(a)(2)(ii)(A) <input type="checkbox"/> 50.73(a)(2)(ii)(B) <input type="checkbox"/> 50.73(a)(2)(iii) <input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A) <input type="checkbox"/> 50.73(a)(2)(v)(A) <input type="checkbox"/> 50.73(a)(2)(v)(B) <input type="checkbox"/> 50.73(a)(2)(v)(C) <input type="checkbox"/> 50.73(a)(2)(v)(D) </div> <div style="width: 50%;"> <input type="checkbox"/> 50.73(a)(2)(vii) <input type="checkbox"/> 50.73(a)(2)(vii)(A) <input type="checkbox"/> 50.73(a)(2)(vii)(B) <input type="checkbox"/> 50.73(a)(2)(ix)(A) <input type="checkbox"/> 50.73(a)(2)(x) <input type="checkbox"/> 73.71(a)(4) <input type="checkbox"/> 73.71(a)(5) <input type="checkbox"/> OTHER <small>Specify in Abstract below or in NRC Form 366A</small> </div> </div>								
12. LICENSEE CONTACT FOR THIS LER											
FACILITY NAME Enrique Villar									TELEPHONE NUMBER (Include Area Code) (856) 339 -5456		
13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT											
CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX		
X	EA	XFRM	W-120	Y							
14. SUPPLEMENTAL REPORT EXPECTED						15. EXPECTED SUBMISSION DATE		MONTH	DAY	YEAR	
<input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE)						<input checked="" type="checkbox"/> NO					
ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)											
<p>On July 7, 2010, at approximately 1118, an automatic reactor trip was initiated due to a turbine trip above 50% reactor power. The turbine trip was the result of the actuation of the regular and back-up phase B-C differential relays in the main generator protection scheme. This actuation was the result of an arc flash across the "B" phase main power transformer bushing following an inadvertent actuation of the transformer fire protection deluge system. The deluge system was actuated by one of the 18 air-pilot sprinkler heads that fused due to the transformer's heat, unusually high ambient temperatures, direct sunlight and restricted ventilation caused by concrete walls that surround three sides of the main power transformer "B" phase. Mist from the deluge system actuation rose above the main power transformer "B" phase bushing, driven by the transformer operating fans, heat rising from the transformer and the close proximity of the concrete wall enclosure, which resulted in the observed arc flash and bushing failure.</p> <p>Corrective actions included replacing the main power transformer deluge system air-pilot sprinkler heads with sprinkler heads that have a higher temperature setpoint.</p> <p>This report is being made in accordance with 10CFR50.73(a)(2)(iv)(A), "any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B)...."</p>											

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NARRATIVE

PLANT AND SYSTEM IDENTIFICATION

Westinghouse – Pressurized Water Reactor (PWR/4)

Main Power Transformer {EA/XFMR}

* Energy Industry Identification System {EIS} codes and component function identifier codes appear as {SS/CCC}

IDENTIFICATION OF OCCURRENCE

Event Date: July 7, 2010

Discovery Date: July 7, 2010

CONDITIONS PRIOR TO OCCURRENCE

Salem Unit 1 was in Operational Mode 1.

No structures, systems or components were inoperable at the time of the discovery that contributed to the event.

DESCRIPTION OF OCCURRENCE

On July 7, 2010, at approximately 1116, with Unit 1 at 100% power and steady state conditions, several fire protection system control room overhead alarms annunciated in the control room. At 1118, shortly after the receipt of these alarms, Unit 1 automatically tripped due to a turbine trip above 50% reactor power. The turbine trip was a result of an actuation of the regular and backup phase B-C differential relays in the main generator protection scheme caused by a fault on the phase "B" of the main power transformer (MPT) {EA/XFMR}. Control room personnel entered the emergency operating procedures to stabilize the plant following the unit trip. At 1156 control room personnel exited the emergency operating procedures and entered the integrated operating procedures, with Unit 1 stable in Mode 3 at normal operating temperature and pressure. All safety related equipment responded as designed.

Unit 1 returned to service (generator output breaker closed) on July 25, 2010, following replacement of the phase "B" main power transformer bushing.

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DESCRIPTION OF OCCURRENCE (cont'd)

This report is being made in accordance with 10CFR50.73(a)(2)(iv)(A), "any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B)...."

CAUSE OF OCCURRENCE

Salem Unit 1 automatically tripped due to a turbine trip above 50% reactor power. The turbine trip was a result of an actuation of the regular and backup phase B-C differential relays in the main generator protection scheme caused by a fault on the "B" phase of the main power transformer.

An ongoing root cause investigation has determined that failure of the main power transformer "B" phase bushing was the result of an arc flash across the bushing following an inadvertent actuation of the transformer fire protection deluge system. The heat from the transformer, unusually high ambient temperatures, direct sunlight and restricted ventilation due to three sides of the main transformer "B" phase being surrounded by concrete walls caused one of the air-pilot sprinkler heads to fuse, with the resultant discharge. The air-pilot sprinkler heads set point was determined to be 165 degrees F per design which was validated by testing 12 other similar air-pilot sprinkler heads.

Although the design of the transformer deluge system is such that upon discharge it does not provide direct water spray onto the transformer bushing, the deluge mist rose above the main power transformer "B" phase bushing, driven by the transformer operating fans, heat rising from the transformer and the close proximity of the block wall enclosure, resulting in the observed arc flash and bushing failure.

PREVIOUS OCCURRENCES

A review of LERs at Salem Station dating back to 2007 identified one reactor trip due to a failure of a major electrical component. LER 272/2007-003 "Salem Unit 1 Automatic Reactor Trip Due to The Failure of 12 Station Power Transformer Load Tap Changer" was issued on February 25, 2008. The cause of the 2007 event was an inadequate scope of maintenance procedures performed on load tap changer internal components and insufficient performance monitoring of degrading load tap changer conditions. The corrective actions taken were specific to the 2007 event and would not have prevented this event.

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SAFETY CONSEQUENCES AND IMPLICATIONS

There was no actual safety consequence associated with this event. Operators appropriately responded to the failure of the main power transformer bushing and subsequent automatic reactor trip. Plant response to the reactor trip was as expected and as designed. All safety systems operated as required.

A review of this event determined that a Safety System Functional Failure (SSFF) as defined in NEI 99-02, Regulatory Assessment Performance Indicator Guidelines, did not occur. This event did not result in a condition that alone could have prevented the fulfillment of a safety function of a system needed to remove residual heat.

CORRECTIVE ACTIONS

1. All Unit 1 main power transformer deluge system air-pilot sprinkler heads were replaced via a design change with air-pilot sprinkler heads set at 286 degrees F.
2. The fire protection deluge system has been isolated requiring manual actuation if necessary. The Unit 2 main power transformer deluge system air-pilot sprinkler heads will be replaced via design change during the next scheduled refueling outage.
3. Additional corrective actions may be taken as appropriate at the conclusion of the root cause investigation.

COMMITMENTS

No commitments are made in this LER.